Announcements

- Homework for tomorrow…

  Ch. 26, Probs. 40 & 50

  Ch. 27, Probs. 24 & 26

CQ7: a. 10 b. 1

CQ8: 2nC/cm²

26.12: a) 0 b) 4,100 N/C

26.14: a) 0 b) 92,000 N/C

- Office hours…

  MW 10-11 am

  TR 9-10 am

  F 12-1 pm

- Tutorial Learning Center (TLC) hours:

  MTWR 8-6 pm

  F 8-11 am, 2-5 pm

  Su 1-5 pm

Chapter 27

Gauss' Law

(*Conductors in Electrostatic Equilibrium*)

Last time…

- *E-field* of a *infinite plane* of charge..

$$E_{plane} = \frac{\eta}{2\epsilon_0}$$

- E-field of a *sphere* (of radius *R*) of charge..

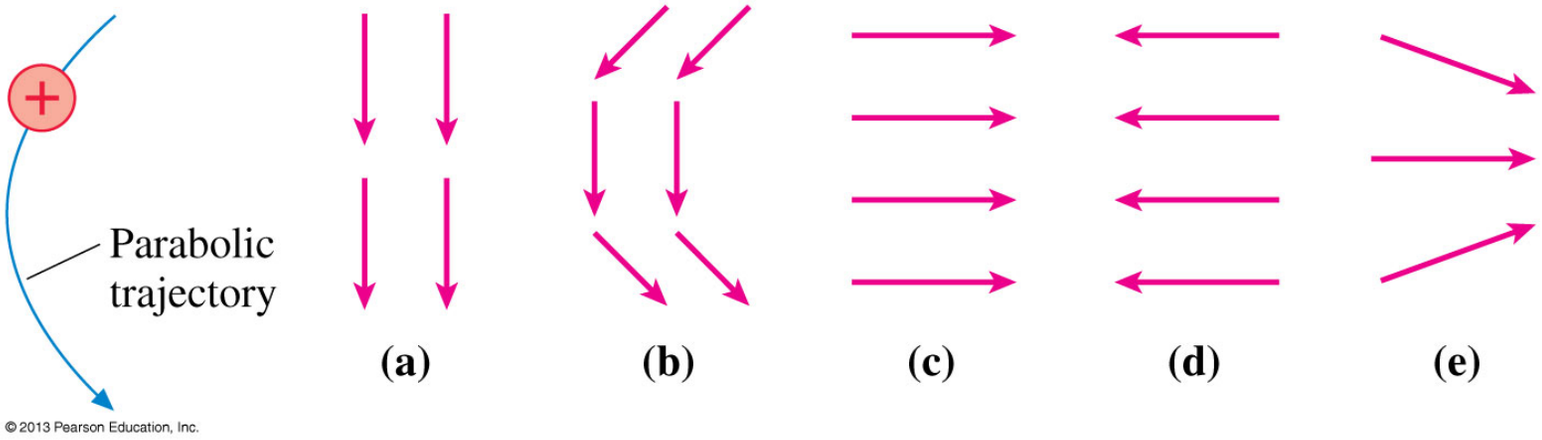
$$E_{sphere} = \frac{1}{4\pi\epsilon_0}\frac{Q}{r^2} \quad \text{for } r \geq R$$

- *E-field* of a *parallel-plate capacitor*..

$$\vec{E}_{cap} = \frac{\eta}{\epsilon_0}$$

Quiz Question 1

Which *E*-field is responsible for the proton's trajectory?



1. (*a*)
2. (*b*)
3. (*c*)
4. (*d*)
5. (*e*)

i.e. 26.9: Deflecting an e^- beam

An e^- gun creates a beam of e^-'s moving horizontally with a speed of 3.3×10^7 m/s. The e^-'s enter a 2.0 cm long gap between two parallel electrodes where the electric field is

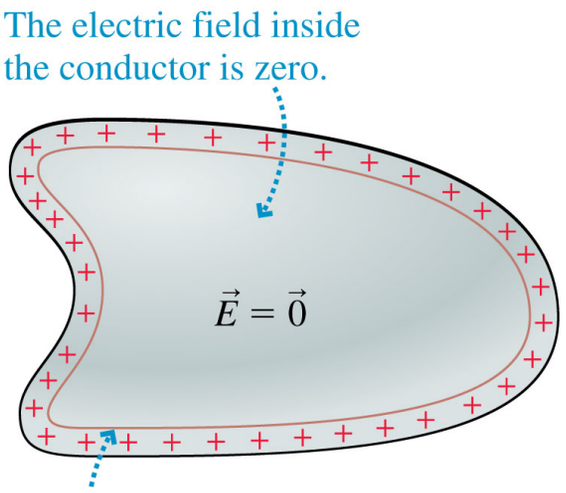
$$E = -(5.0 \times 10^4 \text{ N/C}) \text{ jhat.}$$

In which direction, and by what angle, is the electron beam deflected by these electrodes?

27.6: Conductors in Electrostatic Equilibrium

Consider a charged conductor in *electrostatic equilibrium*...

- all charges are *stationary*.

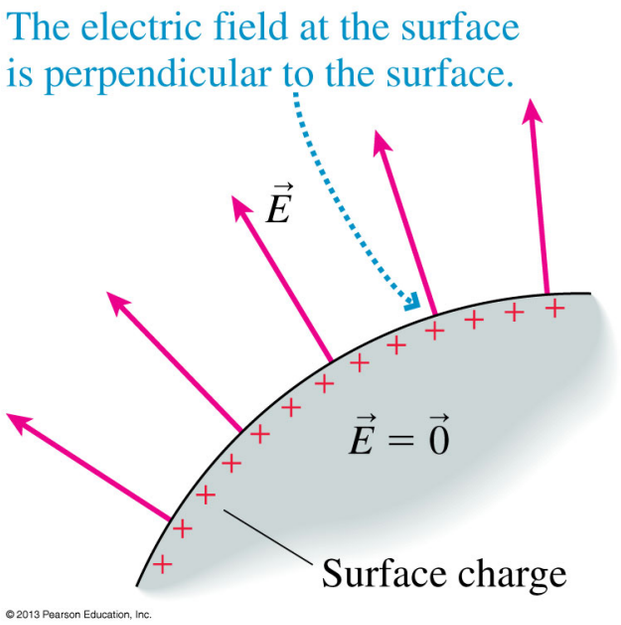


- *E*-field is ZERO at all points w/in the conductor.
- Any excess *q* resides on the *exterior surface*.

Conductors in Electrostatic Equilibrium

Consider a charged conductor in *electrostatic equilibrium*...

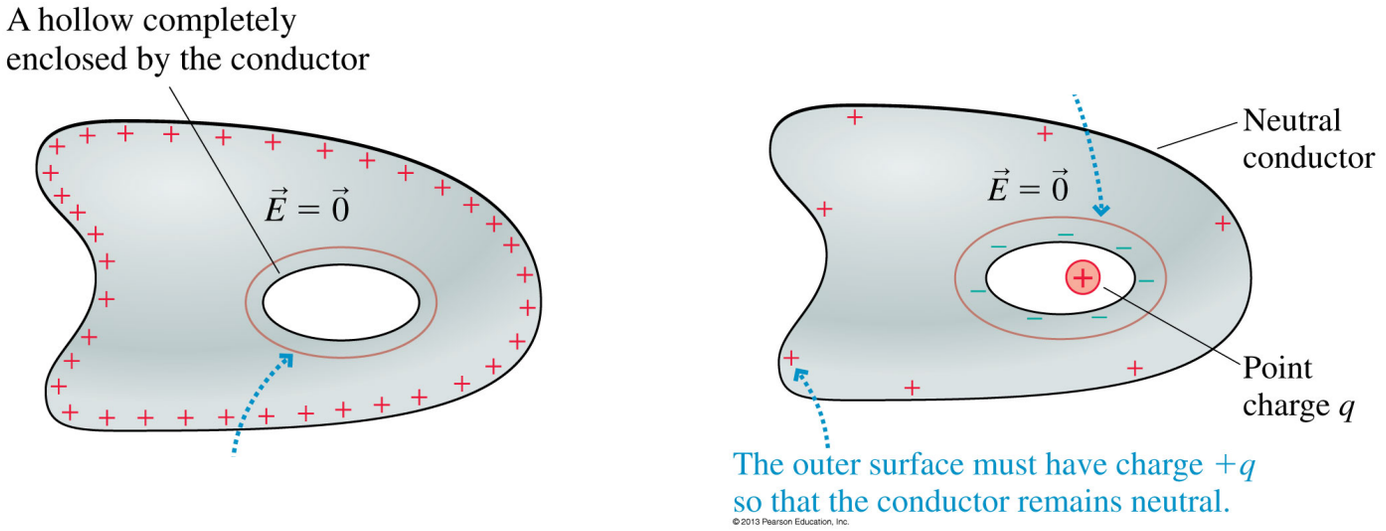
$$\vec{E}_{surface} = \frac{\eta}{\epsilon_0} \text{ , } \perp \text{ to surface}$$



- *E*-field at the surface of a charged conductor..
  - is *perpendicular* to the surface.
  - is of *magnitude* η/ε_0, where η is the surface charge density *at that pt*.

Conductors in Electrostatic Equilibrium

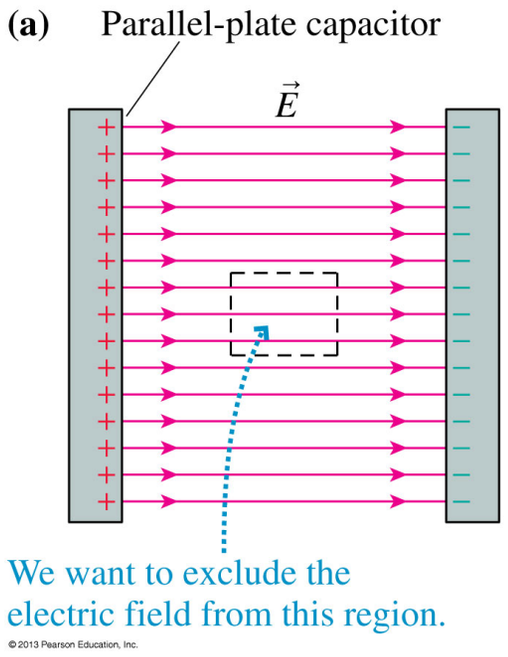
Consider a charged conductor in *electrostatic equilibrium*…



- *E*-field is ZERO inside any hole w/in a conductor, *unless* there is a q in the hole.

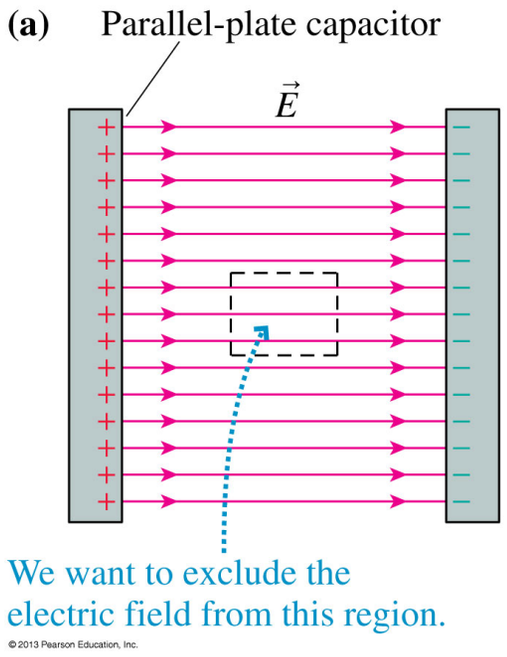
Conductors in Electrostatic Equilibrium

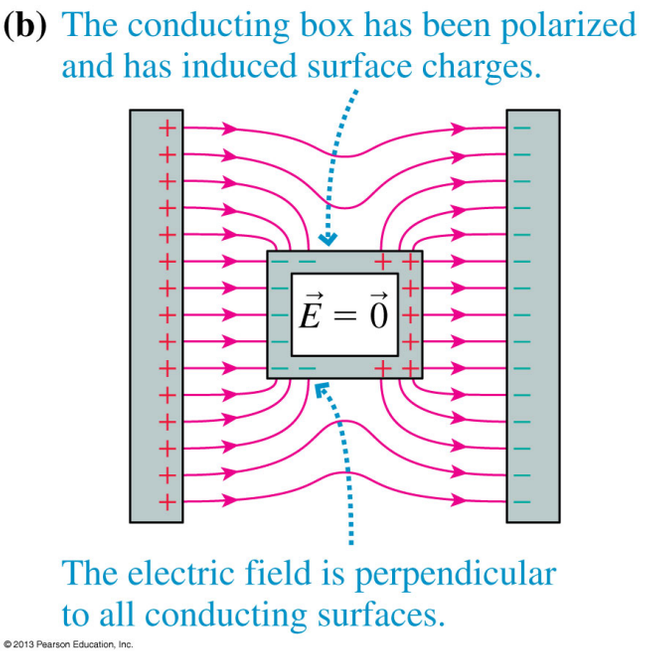
Q: How can we exclude an *E*-field from some region?



Conductors in Electrostatic Equilibrium

Q: How can we exclude an *E*-field from some region?





A: Insert a *neutral conducting box* (a.k.a. *Faraday cage*)

i.e. 27.7: The *E*-field at the surface of a charged metal sphere.

A 2.0 cm diameter brass sphere has been given a charge of 2.0 nC.

What is the *E*-field strength at the surface?

Quiz Question 2

A point charge q is located a distance r from the center of a neutral metal sphere. The E-field at the center of the sphere is

1. $\dfrac{q}{4\pi\epsilon_0 r^2}$
2. $\dfrac{q}{4\pi\epsilon_0 R^2}$
3. $\dfrac{q}{4\pi\epsilon_0 (R-r)^2}$
4. 0
5. It depends on the type of metal.